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# China Report

SCIENCE AND TECHNOLOGY

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20 February 1986

## CHINA REPORT

### SCIENCE AND TECHNOLOGY

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NATIONAL DEVELOPMENTS

LI PENG ADDRESSES BEIJING MEETING ON TECHNOLOGY

OW190622 Beijing XINHUA Domestic Service in Chinese 1650 GMT 18 Jan 86

[Text] Beijing, 18 Jan (XINHUA)--Speaking at a Beijing-area work conference on the application of electronics and information technology which ended today, Li Peng, vice premier of the State Council, said: In employing microcomputers, it is necessary to implement the principle of accomplishing more with less money, and it is also necessary to promote development by means of application.

Li Peng said: In electronics and information technology, Beijing has a great advantage because it has a concentration of one-fourth of the nation's technological personnel. But in the past Beijing failed to make the best use of this advantage and was hindered by the ownership system of various departments and areas. If everyone wants to establish a relatively complete system of one's own, it would be very difficult to unite the individual forces. Now, at the suggestion of the Beijing Municipal CPC Committee and government and with the approval of the Leading Group for Revitalizing the Electronics Industry of the State Council, a Beijing Municipal Leading group for Revitalizing the Electronics Industry has been established. If the group succeeds in organizing Beijing's forces, formulates overall planning, carries out the proper division of labor, unites, and cooperates it will surely be able to implement the principle of accomplishing more with less money, and it will achieve good results. The participation in the today's meeting by the leading persons from the various ministries and commission of the central organs showed that they support an alliance among Beijing's electronics professions and trades.

Li Peng also pointed out that in applying electronics technology, the various units must be pragmatic in suiting their own conditions and should not chase after the most advanced equipment and most sophisticated technology. China is already capable of producing some types of microcomputers. We must use our own products as much as possible.

Li Peng again stressed that in revitalizing the electronics industry, it is necessary to promote development by means of application. He pointed out that the ultimate goal of introducing, digesting, developing, and pioneering electronics technology is to produce our own microcomputers by relying on our own strength. This is the only way to popularize and spread electronics technology and achieve good results. He hoped that Beijing will make a good start in developing electronics products of the means of production and consumer types and in the application of electronics technology.

NATIONAL DEVELOPMENTS

RENMIN RIBAO ON WORK OF SCIENCE FUND ACADEMY OF SCIENCES

HK071300 Beijing RENMIN RIBAO in Chinese 28 Dec 85 p 1

[Report by correspondent Chen Zujia [7115 4371 3966]: "The Chinese Academy of Sciences Scores Remarkable Results in Setting Up Science Funds"]

[Excerpts] Over the last 4 years since the Science Fund was set up by the Chinese Academy of Sciences with a view to supporting the groundwork for the study of basic and applied sciences, initial attempts have been made to explore ways of reforming the scientific research system, thus providing direct experience for initiating a science fund system in China.

Approved by the State Council and established in 1982, the Science Fund of the Chinese Academy of Sciences is a nationwide fund for multidisciplinary natural sciences. Since it was set up 4 years ago, the fund has approved 4,424 subsidized projects with total subsidies of over 172 million yuan. The subsidized projects can be found in some 400 units throughout the country, involving up to 30,000 scientific researchers. According to incomplete statistics for the first half of 1985, 8,228 scientific treatises were completed, 3,097 of which were carried or published in foreign influential academic publications or at scientific conferences. A total of 163 scientific research achievements have passed public appraisal standards or tests by specialists. Some theoretical achievements have reached world advanced levels and are well received by people in the same field at home and abroad, and some achievements of practical use are being tested on a broader scale or popularized.

On 26 December, the Science Fund of the Chinese Academy of Sciences summed up its work over the 4 years since its establishment. Members involved with the fund held that the fund had initially formed a series of management methods which tallied with our national condition in application, examination, approval, and allocation of science funds. The main points of the fund management are macroeconomic guidance, free application, and direct report to a higher body; supporting projects by selecting the most deserving ones in operation through public appraisal by people of the same occupation and examination and approval by a fund group or the Fund; checking and ratifying funds at one go and on an item-by-item basis with funds being allocated by stages and to be used for earmarking funds for specified purposes only; and holding an applicant responsible for the funds he intends to use and expecting the unit where the applicant works to supervise, guarantee, and make regular checks and summaries

on how the applicant uses the funds. Of the important points, two should be stressed: One point is to open up a special fund channel, to reform fund allocation methods, and to replace the practice of distributing funds of the basis of the department, the locality, and the unit, and according to the number of people with a method of allocating funds on an item-by-item basis. The other one is to establish a strict and fair assessment and examination system and to replace administrative examination and approval of projects with assessment and examination by specialists.

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CSO: 4008/1035

NATIONAL DEVELOPMENTS

NATIONAL MEETING ON LOCAL SCIENCE WORK

OW121838 Beijing XINHUA in English 1627 GMT 12 Jan 86

[Text] Beijing, 12 Jan (XINHUA)--In the next five years, the State Science and Technology Commission [SSTC] will organize development of 100 items of technology suitable for rural enterprises and manufacture of related equipment.

This was announced by Teng Teng, vice-minister of the commission, at the opening ceremony of a five-day national meeting on local science work here today, attended by more than 270 people from science and technology commissions and associations in various provinces, municipalities and autonomous regions.

Teng said his commission will also set up 500 demonstration enterprises in the countryside, which will be provided with technological processes, management rules, product designs and quality control methods.

At the same time, he said, the commission will carry out a program to enable one million rural young people with middle school education to learn one or two useful new techniques at short-term courses.

Gao Zhenning, member of the secretariat of the China Association for Science and Technology, told the meeting that scientists and engineers in the association, will make greater efforts to spread technology to rural areas, giving technical training to rural young people and providing technical services to rural enterprises.

Addressing the meeting, State Councillor Fang Yi said the SSTC as a government department and the China Association for Science and Technology as a non-governmental body should cooperate closely at various levels in promoting local economic development by popularizing and applying agricultural technology in line with local conditions.

The on-going economic reform and the expansion of commodity production in rural areas generate a strong need for scientific and technical know-how, he said.

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NATIONAL DEVELOPMENTS

CHINA UNIVERSITY OF SCIENCE, TECHNOLOGY THRIVES

HK210855 Beijing ZHONGGUO XINWEN SHE in Chinese 0349 GMT 17 Jan 86

[Article by Zhu Guanghua [2612 0342 5478] selected from the 11 January KEXUE BAO: "The China University of Science and Technology is Brimming With Vigor and Vitality"]

[Text] At the China University of Science and Technology, there is a rich and free academic atmosphere, with various academic schools and talented people giving full play to their abilities. The school is brimming with vigor and vitality.

At a meeting with Hu Yaobang, the celebrated Professor Ting Chao Chung said: "I spent a day at the China University of Science and Technology this time. It was the most pleasant day of my six visits to China. The people I met at the University of Science and Technology are very young and intelligent." He also said to the reception personnel: "Professors Yang Chen Ning and Lee Tsung Dao have been to the China University of Science and Technology. They told me after their return to the United States that the China University of Science and Technology was run very well and that it had the spirit of blazing new trails and was very promising. I spent a day there on this occasion and got the same impressions as theirs. I have decided to take the China University of Science and Technology as my future partner and to go there on my annual return to China."

How is it possible for the China University of Science and Technology to leave an unforgettable impression with others? This is because it is a plot of fertile land for training the pick of scientists. There is an endless array of posters on various academic reports every day. The hosts include academics who enjoy great prestige at home and abroad, as well as undergraduates and postgraduates who have just taken up research work. No attention is paid to either qualifications and record of service or titles and no approval is needed. So long as you have a unique, new, original, and useful idea, you will be able to win over the audience. Different academic schools may also "put on shows on the same stage" so as to make up for each other's deficiencies and to constantly blaze new trails. For example, since its founding in 1973, the astrophysics center of the university has always adhered to the principle of freely proposing research topics, freely forming research groups, and conducting free discussions. They hold a 2-hour academic symposium every Friday, at which one

person gives a lecture on a certain topic and joint discussions are held. Although they have different views on the formation of scale pattern [che du jie gou 1439 1653 4814 2845] in the universe, they have always approached the subject together, learned from each other by exchanging views, and thus constantly raised their academic levels. In recent years, the center has contributed more than 200 papers to academic journals at home and abroad and won first and their prizes from the International Gravitational Studies Society in 1985. The center has become an eminent new force in the field of astrophysics.

People say that at the China University of Science and Technology, young people can display their talents and intellectual power to the full. Indeed, the university gives a free hand to young and middle-aged scholars in teaching research, and the administration and allows them to "play a leading role" on the forefront. Its lecturers, the persons responsible for its research projects, the directors of its teaching and research sections and its laboratories, and the responsible persons of its schools, offices, and departments are mostly young or middle-aged persons. The university encourages young people to be pathbreakers on the scientific and technological forefront. Last year, Suzhou hosted an annual symposium on thermophysics. Of the papers read at the symposium, 13 were contributed by this university and, of the 9 persons attending the symposium by invitation, 6 were postgraduate students who either were still studying or had just graduated. This aroused the curiosity of other participants.

In recent years, the university has been pursuing an opening up policy. It has successively sent more than 600 young and middle-aged teachers and students abroad to further their studies. More than 200 of them have returned and they have offered more than 100 new courses at the university. At a recent conferral of academic titles, the university did not take seniority and the number of years of service into consideration. It only took contributions into consideration. Thanks to the decisions made by the university's Academic Titles Committee, the university now has 6 professors and 54 associate professors who are under 45. Some of them are winners of the First Class Major Scientific and Technological Achievements Awards given by the Chinese Academy of Sciences.

Academic freedom necessarily stems from political democracy. Since its founding, the leaders of the university have demonstrated a democratic style. Thanks to the implementation of the principle of making the cadres "more revolutionary, younger in average age, better educated, and more professionally competent," some specialists have assumed leading posts. The university pays close attention to preventing "people in the same fields from intriguing against one another" and encourages its teachers to play their role as masters of the university in running the university. Shortly after the formation of its new leading body, the university organized its Degrees and Academic Titles Committee. A corresponding committee can also be found in each department. Each of these committees has its say on research funding, approving research projects, and the conferment of academic titles and degrees. The university's six leaders are each responsible for specific schools, offices, and departments on a contract basis. They always visit various units in order to find out how things are doing. Saturday afternoons are designated "presidential reception

days." The university's president and vice presidents take turn to receive visiting teachers and students. Whoever wants to see the university's leaders on other weekdays can make appointment at their offices. The university has built a teachers' amenity center. The university's leader always participate in their activities on weekends in order to befriend them and to communicate with them. After the central authorities circulated their decision on reforming the education system, the university drafted eight measures for implementing this decision. In addition, it has also solicited opinions at a teachers' congress, where the university's leaders personally listened to queries and faced challenges. At a meeting which lasted less than a half day, President Guan Weiyan ascended the platform seven times to answer questions. The comrades attending the meeting were impressed by the vivid scene.

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## NATIONAL DEVELOPMENTS

### LIAONING ACHIEVEMENTS DURING SIXTH 5-YEAR PLAN PERIOD NOTED

SK231303 Shenyang Liaoning Provincial Service in Mandarin 1030 GMT 21 Dec 85

[Text] During the Sixth 5-Year Plan period, our province's animal husbandry has vigorously developed. The output of major animal by-products has continuously increased. According to statistics, the province's total meat output this year is estimated at 620,000 tons, thus attaining the target set in the Sixth 5-Year Plan period and showing an increase of 39.6 percent over 1980. The total output of milk products is expected to reach 115,000 tons, exceeding the Sixth 5-Year Plan by 4 percent. The total egg output is expected to reach 311,000 tons, exceeding the Sixth 5-Year Plan by 38 percent. Thanks to the development of animal husbandry, its proportion of output value in the agricultural sector has increased. It is expected that the output value in 1985 will reach 1.97 billion yuan, exceeding the Sixth 5-Year Plan by 4 percent.

During the Sixth 5-Year Plan period, the province has invested 170 million yuan in road construction, has newly built and reconstructed 22 railway overpasses and bridges spanning rivers, and has surfaced highways totaling 210 km. The province has invested 120 million yuan in highway transportation, and has added 1,300 public streetcars and motor vehicles, 400 rental cars, and passenger transport lines totaling 384 km so the situation in which some citizens find it hard to use public bus transportation has been eased slightly.

During this period, we have also witnessed great progress in the development of urban gas supply and the central heating system. The province has increased artificial coal gas and natural gas by 410,000 cubic meters daily and liquified gas by 32,000 tons. The number of gas consumers has increased by more than 200,000. Six cities, including Shenyang, Dalian, and Fushun, have ensured central heating supply to housing areas covering 20 million square meters, accounting for one-third of the province's housing areas.

During the Sixth 5-Year Plan period, Liaoning has scored achievements in preventing and curing endemic diseases which have rarely been seen since the founding of the PRC. The rate of contract various sorts of diseases has dropped by a large margin and diseases have been effectively brought under control. Compared with 1980, the year before the Sixth 5-Year Plan period, the rate of contracting endemic goiter dropped by 35.5 percent and the rate of curing this disease increased by 26.2 percent this year. The incidence of acute and subacute Keshan diseases and the mortality rate of the people

suffering from these diseases has been at zero over the past 4 successive years. The number of persons contracting the Kaschin-beck disease dropped by 29 percent.

The number of projects and facilities for preventing fluorine poisoning and improving the water quality and the number of persons who have benefited from this have increased 2.9 times and 4.6 times, respectively. Over the past 5 years, Liaoning's rural areas have carried out six projects for preventing fluorine poisoning and improving the water quality, five of which have been completed. Some 300,000 people have benefited.

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CSO: 4008/1035

## NATIONAL DEVELOPMENTS

### SHAANXI HOLDS CONFERENCE ON ELECTRONICS INDUSTRY

HK080833 Xian Shaanxi Provincial Service in Mandarin 2300 GMT 6 Jan 86

[Text] The province's electronics industry is discussing the superiority of developing consortium enterprises and the promotion of regional ties. At a recent provincial conference of electronics enterprise managers, the managers held that the correct way to invigorate the province's electronics industry is to strengthen extensive economic ties and to give play to local advantages.

During the Sixth 5-Year Plan period, the province's electronics industry developed at an average growth rate of 36 percent in output value. It gradually formed a new base of enterprises focusing on television sets, electronic component parts, electronic calculators, and special electronic devices. The electronics industry has thus become one of the main industries of the province.

The provincial electronics industry department has regarded the development of regional ties and promoting the superiority of consortium enterprises as the key measures for implementing the Seventh 5-Year Plan. In connection with the decision, it has conducted comprehensive investigation and discussion.

The managers participating in the conference held that the decision on promoting ties embodied the spirit of reform. It conformed to reality and was feasible. At present, we should develop ties on two levels. First, we should develop regional ties, which are mainly information exchange, discussion of development strategy, capital raising, and developing markets. Second, we should develop specialized companies, joint companies, and other economic entities so as to improve our production capacity and competitiveness.

The Provincial CPC Committee and government are much concerned about reforms in developing the advantages of electronics industry consortia. Sun Kehua, vice governor, and responsible comrades of the Provincial Planning Committee, the Provincial Economic Committee, and the Provincial Office for Structural Reform also attended the conference. They encouraged the electronics industry to make concerted efforts and advocate reforms, and to make more contributions to invigorating the economy of Shaanxi.

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CSO: 4008/1035

NATIONAL DEVELOPMENTS

BRIEFS

HAN SUYIN'S RESEARCH FUND--Beijing, 12 Jan (XINHUA)--British writer Dr. Han Suyin announced the establishment of the Han Suyin trust fund for scientific exchanges between China and Europe at a press conference here today. The first nongovernmental organization of its kind, it will help train Chinese scientific decision makers and promote exchanges of researchers between China and other countries. Chinese women scientists will benefit from 50 percent of the fund's money, Dr. Han said. Dr. Han, 68, president of the fund, told reporters that she expects to increase the fund gradually through the money she earns from her books. All seven members of the board of directors will give their services voluntarily, she stressed. Han arrived here 9 January as a guest of the Chinese People's Association for Friendship with Foreign Countries. [Text] [Beijing XINHUA in English 1030 GMT 16 Jan 86 OW] /12712

CAS FUND AIDS YOUNG SCIENTISTS--Beijing, 15 Jan (XINHUA)--The Chinese Academy of Sciences [CAS], for the first time, has provided a total of 2.51 million yuan to aid 140 young scientists in their research. Earlier last year, the academy set up a science fund to foster young scientists under the age of 35. The youngest to receive a grant is 22 years old, and 13 have studied abroad. Zhang Yingzhi of the Shanghai Institute of Organic Chemistry, who received a PhD at London University, was granted a sum of 40,000 yuan for her research on the application of palladium complex compound in organic synthesis. Qian Min, 22, of the Purple Mountain Observatory in Nanjing, received a fund of 15,000 yuan for research on satellite measurement and control data processing. A CAS official said the academy would continue to allocate a certain sum every year for scientific research undertaken by promising young scientists. [Text] [Beijing XINHUA in English 1235 GMT 15 Jan 86 OW] /12712

CAS EXPANDS DOMESTIC, FOREIGN TIES--Beijing, 27 Jan (XINHUA)--China's open policy has enabled its Academy of Sciences to expand its ties with institutions both inside and outside of the country. By the end of 1985, the Chinese Academy of Sciences [CAS] had signed long-term scientific and technical co-operation agreements with 12 provinces, municipalities, ministries and a number of open coastal cities. The branch institutes offer technical services, including sharing scientific results and offering technical consulting. More than 100 cooperatives have been set up between the branch institutes and production units, and thousands of scientists and technicians have been invited to be technical advisors and directors. Last year, the CAS opened two Beijing institutes--the Institute of Theoretical Physics and the Institute of

Mathematics--and 17 laboratories to scientists and researchers. More than 700 scientists from the fields of education, scientific research and industrial businesses and 32 foreign experts have been approved to work in these institutes and laboratories. CAS has contacts with 50 countries and regions and has concluded 43 agreements and memoranda on science and technology. While setting up cooperative agreements with foreign partners, the academy has attracted a number of international academic conferences and foreign scholars to China. [Text] [Beijing XINHUA in English 1030 GMT 27 Jan 86 OW] /12712

GRADUATE STUDENT ENROLLMENT--Beijing, 30 Aug (XINHUA)--Registration started today for the 43,416 master's degree students enrolled this year, according to the State Education Commission. This figure almost doubled last year's figure of 22,920. Classes will begin next week. In Beijing, where schools of higher learning and research institutes are more concentrated, the enrollment reached over 10,600, surpassing the annual figure of the previous years and making up for one-third of the nation's total. Among the new recruits in Beijing, 34 percent are on-the-post university graduates. In addition, as a trial practice in reforming the enrollment system, Beijing has also included in its total, over 800 outstanding college graduates who were enrolled at the recommendation of their colleges without taking an entrance examination. [Text] [Beijing XINHUA in English 0758 GMT 30 Aug 85 OW] /12712

GUANGDONG'S SCIENTIFIC RESEARCH UNITS--In the wake of reforms, some 90 percent of Guangdong's scientific and technological research units have established comprehensive links with production ones. Over the past four years, the research units developed one new achievement per day on average. In addition, about 30 percent of the achievements made were popularized and totally brought about more than 500 million yuan of economic results. [Summary] [Guangzhou Guangdong Provincial Service in Mandarin 1000 GMT 20 Jan 86 HK] /12712

MANAGEMENT REGULATIONS ADOPTED--Beijing, 16 Dec (XINHUA)--China's first state standards for managing radio science--"requirements in Electromagnetic Environment for Aeronautical Navigation Stations"--were approved today after examination. The examination was jointly sponsored by the relevant departments of the State Council and the Central Military Commission. Representatives, experts, and professors from 49 units all over the nation held that the "Requirements in Electromagnetic Environment for Aeronautical Navigation Stations," which scientifically solves the growing problem of mutual interference between aeronautical and non-aeronautical navigation stations, marks a shift from management of radio science based on experience to scientific management. [By reporter Sun Maoging] [Text] [Beijing XINHUA Domestic Service in Chinese 0837 GMT 16 Dec 85 OW] /12712

CSO: 4008/1035



PHYSICAL SCIENCES

ON COMPUTER-AIDED PROGRAMMING OF PAL DEVICES

Hangzhou ZHEJIANG DAXUE XUEBAO (ZENGKAN) [JOURNAL OF ZHEJIANG UNIVERSITY (SUPPLEMENT)] in Chinese "Special Issue on Computers" 25 Jul 85 pp 124-132

[Article by Tao Xin [7118 2946] and Pu Shuliang [3184 2885 5328]]

[Text] Abstract: Programmable Array Logic (PAL) is a new semi-conductor device with powerful functions and broad applications. On the basis of an in-depth analysis of the PAL-20 series products produced by the U.S. MMI [Monolithic Memories, Inc.] company, this paper designed a PAL device programmer which can be connected to any computer as long as it has a parallel interface. This paper provides the hardware logic diagram and the software programming flowcharts. It will be an effective tool for computer hardware developers.

I. Overview

1. Characteristics of PAL Devices

The PAL device is a new fusible programmable integrated circuit which appeared on the heels of other programmable ROM. With the constant development of large scale integrated circuits, the functions of single chip integrated circuits became more and more powerful, and the appearance of CPU and various programmable interface chips provided the material foundation for developing computer systems which were small in size and powerful in functions. However, in addition to requiring a small number of LSI (large scale integrated circuits), a computer hardware system also must have a fairly large number of SSR (small scale integrated circuits) and MSI (medium scale integrated circuits) to coordinate between the LSI devices, and frequently in the physical space of a complete hardware system, this part takes up a very large proportion which is an important factor influencing the reliability of the system's operation because the large use of SSI and MSI devices increases the complexity of the wiring and thus the assembly precision of printed circuit boards could not be improved. This is a problem which frequently troubles computer logic designers now.

To be sure, if it was only to reduce mass, these SSI and MSI devices could be integrated into one chip using LSI technology, but it must be understood that these SSI and MSI devices in a system are very irregular and it is difficult to increase the degree of integration; furthermore, designing and developing a special use integrated circuit for one special system not only lengthens

the development time and increases costs, but it also loses the advantage of MSI-SSI flexibility. Therefore, this method is not adoptable.

The bipolar PAL device provided by the U.S. MMI company and others satisfactorily resolves the above contradiction. It has both the high speed of the TTL and the flexibility of programmability and is now a widely used device in the design of computer hardware systems and other digital systems.

In addition to high speed and flexibility, PAL has an even more valuable characteristic of a high degree of privacy of its internal information, thus it is very difficult for competitors to dissect and reproduce it. Of course, this characteristic is a great difficulty for China which has adopted a policy of analyzing imported technology and then developing our own products. Thus, promoting the use of PAL devices first of all requires solving the two problems of how to analyze wired PAL devices in programmed systems and how to program PAL devices on the basis of our own design demands. The degree of emphasis of these two tasks is different and relatively independent. This paper discusses primarily the latter. The author plans another paper discussing the problem of analyzing wired PAL devices.

## 2. Method of Representing PAL

As discussed above, devices developed on the basis of fusible PROM, and is a special form of PROM. The two are made up of an array of AND-OR gates. For ease of discussion, the following symbols will be used to represent the AND-OR array. Figure 1 is an AND-OR array which has two input terminals and one output

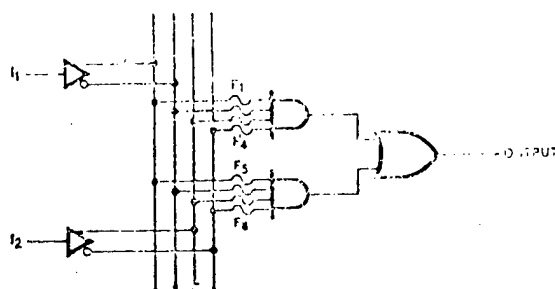


Figure 1

terminal. Its ordinary logic form can be described as

$$\begin{aligned} \text{OUTPUT} = & (L_1 + \bar{f}_1) (\bar{L}_1 + \bar{f}_2) (L_2 + \bar{f}_3) (\bar{L}_2 + \bar{f}_4) \\ & + (L_1 + \bar{f}_5) (\bar{L}_1 + \bar{f}_6) (L_2 + \bar{f}_7) (\bar{L}_2 + \bar{f}_8) \end{aligned}$$

in which  $L_1$  and  $L_2$  are input signals and  $f_1$  is the fuse state in the array:  $f=0$  means the fuse is blown;  $f=1$  means the fuse is retained.

In an unprogrammed PAL device, all the fusable links still exist, thus its initial OUTPUT = 0.

For convenience, the logic diagram such as the one illustrated in Figure 1 is simplified to the form given in Figure 2. This is different from the method of representing ordinary logic circuits.

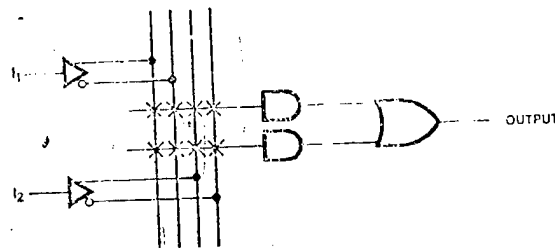


Figure 2

If we wish to establish the following logical equation:

$$\text{OUTPUT} = L_2 \cdot L_2 + L_1 \cdot L_2$$

we can represent it with Figure 3.

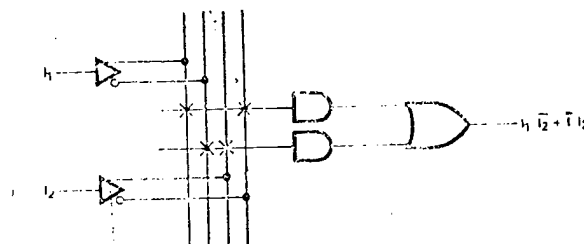


Figure 3

The points of intersection marked X mean the fuses still exist, and those without Xes are points where fuses have been blown.

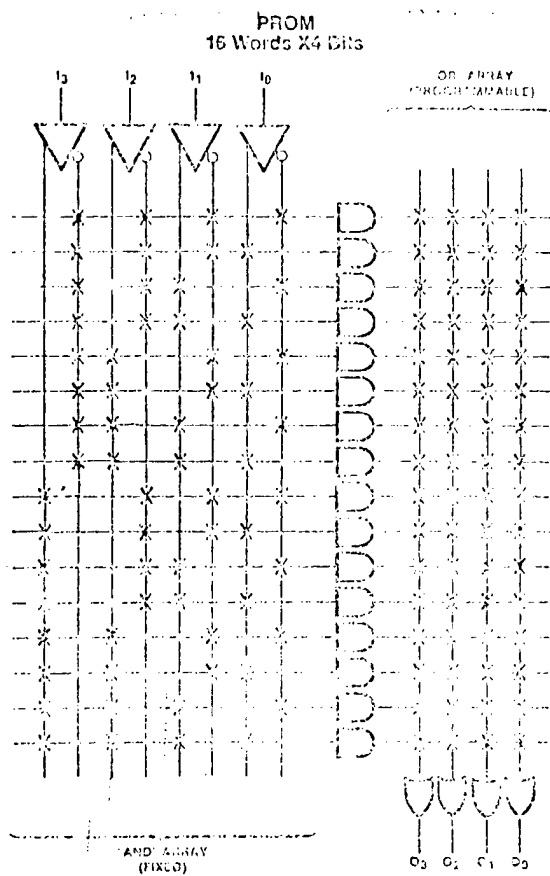


Figure 4

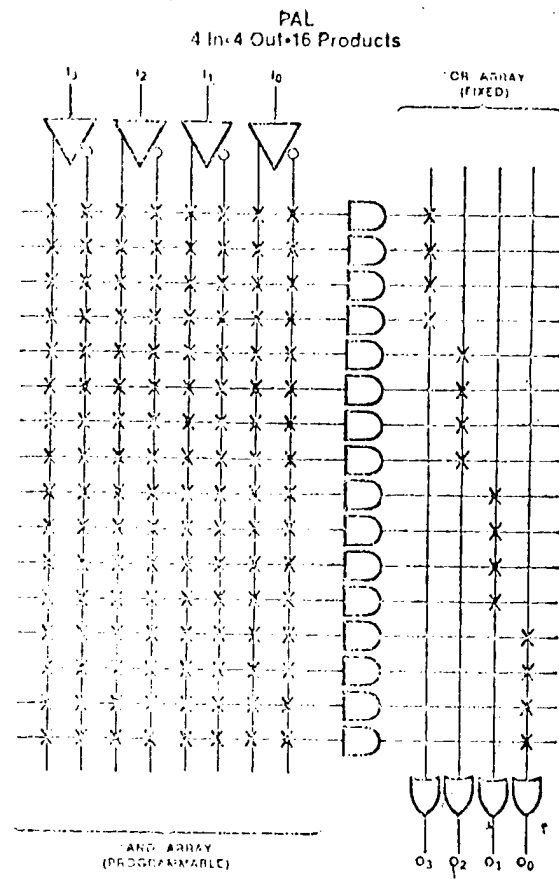


Figure 5

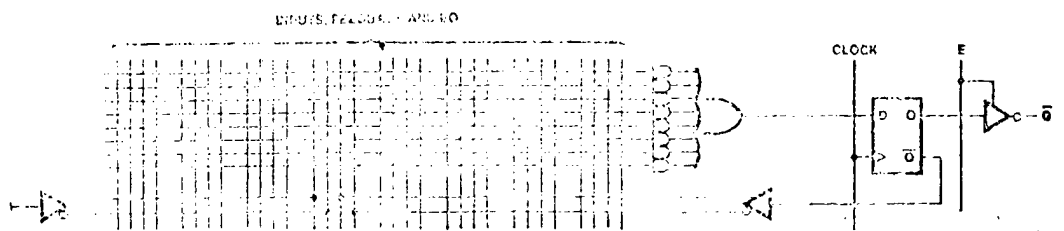


Figure 6

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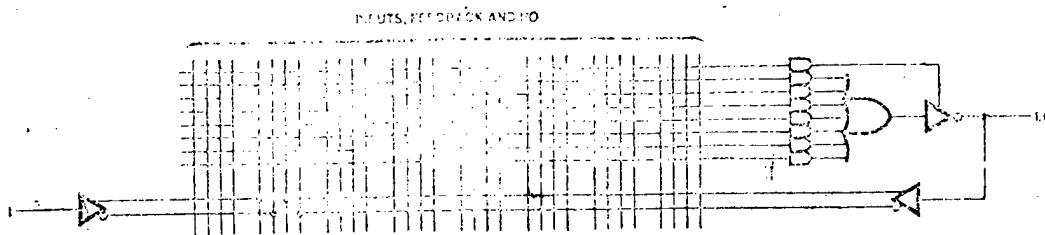


Figure 7

### 3. Comparison of PAL and PROM

The primary differences between PAL and PROM are: the AND gate arrays in PROM devices are burned in, and the OR gate arrays are programmable; it is the opposite with a PAL device, its AND gate is programmable and the OR gates are burned in, as illustrated in Figures 4 and 5 respectively. In addition, some types of PAL devices use register output and their output also feeds back as part of input, as illustrated in Figure 6, some pins of PAL devices can be input and can also be output, programmable by the user, as illustrated in Figure 7. For this reason, the PAL devices are more flexible than PROM in constructing logic circuits.

## II. Programming Principles of PAL Devices

This paper discusses mainly the PAL-20 series products produced by the U.S. MMI company.

The PAL device is programmed by blowing some fuses in the device and leaving some fused, depending on the logic functions which the user wishes to implement. As mentioned above, the PAL device is different from the PROM: when programming a PROM, fuse selection is sequentially selecting the fuse node conveniently through continuous changes in the address wires, but programming the PAL device requires only the AND gate array fuses, its internal design is made up of 32 input lines and 64 product lines forming a 32 x 64 fuse node matrix. The number of fuses and their distributional position included in different model devices are different, as explained by the factory's product manual. These 32 input lines and 64 product lines are clear to the user. When the user is programming, he needs only to apply different levels to external pins (this array has 20 pins) to make the selection of input lines and product lines and thus at once determine a fuse which must be programmed.

As an example, we will explain the programming principles by the method of using a PAL device to make up a six gate circuit.

Supposing the logic equation of a six-gate circuit was respectively,

$$B = \bar{A}; E = C*D; H = F+G;$$


$$O = \bar{M}\bar{N}; R = P*\bar{Q}+\bar{P}*Q; L = \bar{I}+\bar{J}+\bar{K}$$

The steps are roughly as follows:

1) Select the suitable model on the basis of design demands. In this example, six output terminals and 12 input terminals are required, and high level output is effective. On this basis, selecting PAL12H6 will satisfy the demand.

2) Each pin on the device is named corresponding to the demands, such as 1-C; 2-D....18-B, 19-A, as illustrated in Figure 8.

3) Select the fuse state, i.e., on the basis of the logic equation determine which fuses should be blown and which should be retained. For example, to obtain  $B = \bar{A}$ , find in the diagram the output terminal defined as B. It corresponds to four product lines, labeled respectively 8, 9, 10, and 11. Each of the product lines is related to the positive/negative variable of 12 input terminals, finding the input line corresponding to  $\bar{A}$  is 7, an x is placed at the intersection of product line 8 and input line 7 to indicate that this fuse should be retained, and the other fuses on product line 8 are all blown, thus the AND gate output corresponding to product line 8 is A and all the fuses on product lines 9, 10, and 11 are all retained, represented

in the figure by , the output of these three AND gates is 0, therefore, the output of the AND-OR gate is  $\bar{A}$ . By the same token, to get  $E = C*D$ , on the 16th product line corresponding to E output the intersecting fuses of input lines 0 and 1 related to C and D are retained and the others are all blown and the fuses on the other product line corresponding to E are all retained. Proceeding in this fashion one can obtain the fuse state diagram illustrated in Figure 8.

4) On the basis of the fuse state information obtained above, a programmed pulse applied to the fuse nodes which must be blown, blows the fuses.

The first two steps in the process described above are easily determined by the user on the basis of design demands and with reference to the appropriate reference manuals. If the third step is carried out manually, it will be a very tedious job and not only will it take a great deal of time but it is also easy to make a mistake and since the programming of a PAL device is a one-time thing, once there is a failure, the device must be scrapped. For this reason, a special procedure--a "logic converter" program--provided by the programmer carries it out. The fourth step cannot be undertaken manually, either. It is carried out by the programmer's special hardware module--the

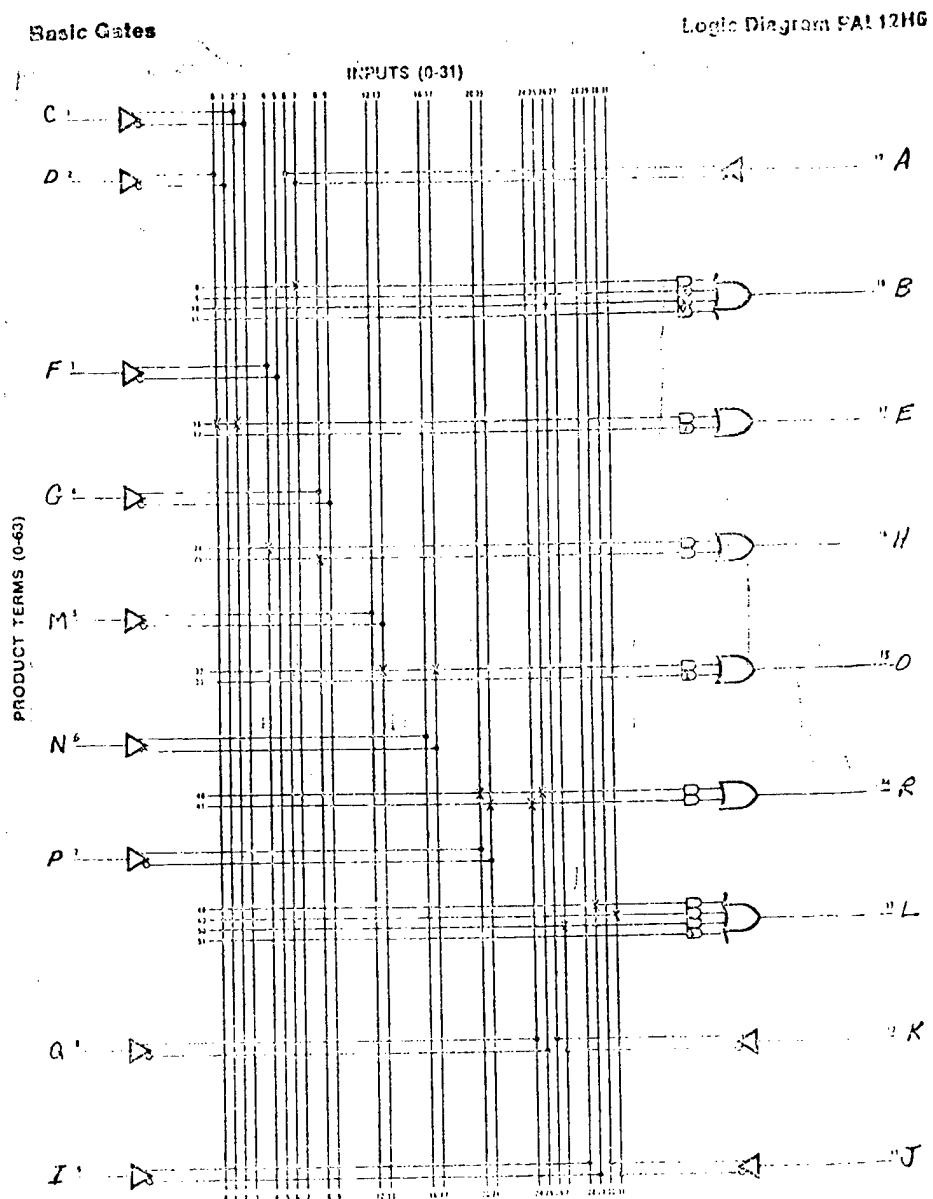


Figure 8

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programming circuit--with the help of a suitable control program. The logic converter program and the programming circuit are the two central modules of the entire programmer and below we will stress the design thinking of these two modules in a brief discussion.

### III. Hardware and Software Design of the PAL Programmer

#### 1) PAL Programming Circuit

The main function of the programming circuit is to provide, on the basis of the PAL device's internal decoding mechanism, the combined signal of a specially designated level for the device's pins in order to select the internal input lines and product lines and produce a programming pulse.

Determination of the level signal group method is derived from the input line select and product line select truth table provided in the factory's product guide. It is as illustrated in the tables below.

INPUT LINE NUMBER	PIN IDENTIFICATION									
	I <sub>7</sub>	I <sub>6</sub>	I <sub>5</sub>	I <sub>4</sub>	I <sub>3</sub>	I <sub>2</sub>	I <sub>1</sub>	I <sub>0</sub>	L/R	
0	HH	HH	HH	HH	HH	HH	HH	L	Z	
1	HH	HH	HH	HH	HH	HH	HH	H	Z	
2	HH	HH	HH	HH	HH	HH	HH	L	HH	
3	HH	HH	HH	HH	HH	HH	HH	H	HH	
4	HH	HH	HH	HH	HH	HH	L	HH	Z	
5	HH	HH	HH	HH	HH	HH	H	HH	Z	
6	HH	HH	HH	HH	HH	L	HH	HH	HH	
7	HH	HH	HH	HH	HH	H	HH	HH	HH	
8	HH	HH	HH	HH	L	HH	HH	HH	Z	
9	HH	HH	HH	HH	H	HH	HH	HH	Z	
10	HH	HH	HH	HH	L	HH	HH	HH	HH	
11	HH	HH	HH	HH	H	HH	HH	HH	HH	
12	HH	HH	HH	HH	L	HH	HH	HH	Z	
13	HH	HH	HH	HH	H	HH	HH	HH	Z	
14	HH	HH	HH	HH	L	HH	HH	HH	HH	
15	HH	HH	HH	HH	H	HH	HH	HH	HH	
16	HH	HH	HH	L	HH	HH	HH	HH	Z	
17	HH	HH	HH	H	HH	HH	HH	HH	Z	
18	HH	HH	HH	L	HH	HH	HH	HH	HH	
19	HH	HH	HH	H	HH	HH	HH	HH	HH	
20	HH	HH	L	HH	HH	HH	HH	HH	Z	
21	HH	HH	H	HH	HH	HH	HH	HH	Z	
22	HH	HH	L	HH	HH	HH	HH	HH	HH	
23	HH	HH	H	HH	HH	HH	HH	HH	HH	
24	HH	L	HH	HH	HH	HH	HH	HH	Z	
25	HH	H	HH	HH	HH	HH	HH	HH	Z	
26	HH	L	HH	HH	HH	HH	HH	HH	HH	
27	HH	H	HH	HH	HH	HH	HH	HH	HH	
28	L	HH	HH	HH	HH	HH	HH	HH	Z	
29	H	HH	HH	HH	HH	HH	HH	HH	Z	
30	L	HH	HH	HH	HH	HH	HH	HH	HH	
31	H	HH	HH	HH	HH	HH	HH	HH	HH	

Table 1 Input Line Select

PRODUCT LINE NUMBER	PIN IDENTIFICATION							
	O <sub>3</sub>	O <sub>2</sub>	O <sub>1</sub>	O <sub>0</sub>	A <sub>2</sub>	A <sub>1</sub>	A <sub>0</sub>	
0.32	Z	Z	Z	HH	Z	Z	Z	
1.33	Z	Z	Z	HH	Z	Z	HH	
2.34	Z	Z	Z	HH	Z	HH	Z	
3.35	Z	Z	Z	HH	Z	HH	HH	
4.36	Z	Z	Z	HH	HH	Z	Z	
5.37	Z	Z	Z	HH	HH	Z	HH	
6.38	Z	Z	Z	HH	HH	HH	Z	
7.39	Z	Z	Z	HH	HH	HH	HH	
8.40	Z	Z	HH	Z	Z	Z	Z	
9.41	Z	Z	HH	Z	Z	Z	HH	
10.42	Z	Z	HH	Z	Z	HH	Z	
11.43	Z	Z	HH	Z	Z	HH	HH	
12.44	Z	Z	HH	Z	HH	Z	Z	
13.45	Z	Z	HH	Z	HH	Z	HH	
14.46	Z	Z	HH	Z	HH	HH	Z	
15.47	Z	Z	HH	Z	HH	HH	HH	
16.48	Z	HH	Z	Z	Z	Z	Z	
17.49	Z	HH	Z	Z	Z	Z	HH	
18.50	Z	HH	Z	Z	Z	HH	Z	
19.51	Z	HH	Z	Z	Z	HH	HH	
20.52	Z	HH	Z	Z	HH	Z	Z	
21.53	Z	HH	Z	Z	HH	HH	Z	
22.54	Z	HH	Z	Z	HH	HH	HH	
23.55	Z	HH	Z	Z	HH	HH	HH	
24.56	HH	Z	Z	Z	Z	Z	Z	
25.57	HH	Z	Z	Z	Z	Z	HH	
26.58	HH	Z	Z	Z	Z	HH	Z	
27.59	HH	Z	Z	Z	Z	HH	HH	
28.60	HH	Z	Z	Z	HH	Z	Z	
29.61	HH	Z	Z	Z	HH	Z	HH	
30.62	HH	Z	Z	Z	HH	HH	Z	
31.63	HH	Z	Z	Z	HH	HH	HH	

Table 2 Product Line Select



In the table, L = low level input voltage

H = high level input voltage

HH = high level programming voltage

Z = high impedance

It is not hard for us to find the selection rules in the truth tables. From the product line select table we can tell that the conversion rules of pins  $A_0A_1A_2$  can actually be described as a binary counter and the conversion rules of  $O_0-O_4$  can be described as a shift register. The counter and register output drive a special driver circuit which has two states Z and HH, and from the input line select table we can tell that the L/R signal can be described as a flip-flop that operates in counting mode, so that each time the product line changes twice, L/R changes once. The conversion rules of signals  $A_0-A_7$  also can be described as a shift register of successive shifts. The difference from the above is that the  $A_0-A_7$  signals are driven by a special driver circuit which has the three states H, L, and HH.

In addition, the PAL device designers cleverly designed a completely symmetrical internal array, and thus the 2048 fuse nodes can be programmed twice, programming the former 1024 and the latter 1024 separately, requiring only that the pins be given different definitions but not requiring that the connections be changed. This is as illustrated in Figure 9.

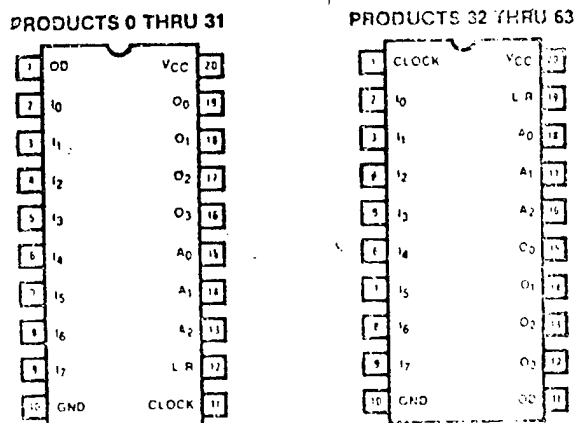


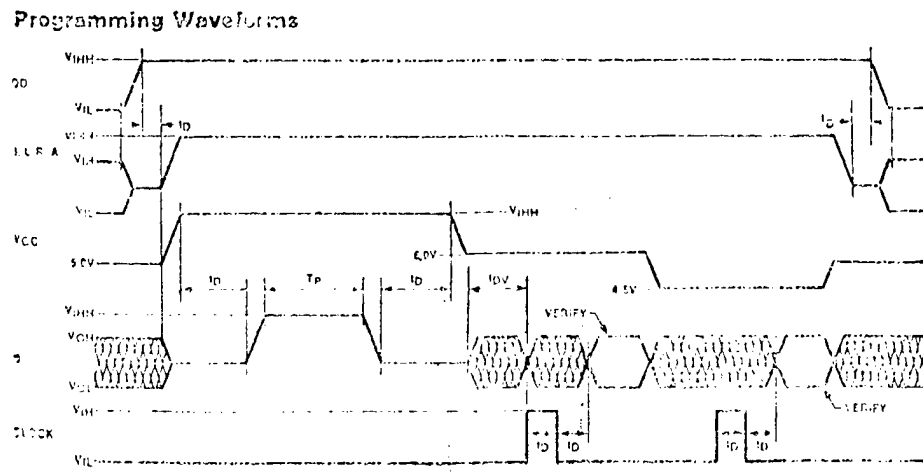
Figure 9

$I_0-I_7$  and L/R are used for selecting the input line

$O_0-O_3$  and  $A_0-A_2$  are used for selecting the product line

OD - output prohibited

The arrangement in the left hand figure is for programming product lines 0-31 (the former 1024 fuses) and the arrangement on the right is for programming product lines 32-63 (the latter 1024 fuses).



Summarizing the above, we can draw the logic diagram illustrated in Figure 11.

The entire logic system has only four signals to the outside, i.e., pure "0" sets fuses to initial state once, starts programs address conversion--prepares for programming once, pin redefinition--after 1024 fuses have been programmed, the pins are redefined for programming the other half of the fuses. This system can be linked by parallel interface to any computer to form a general purpose PAL programmer.

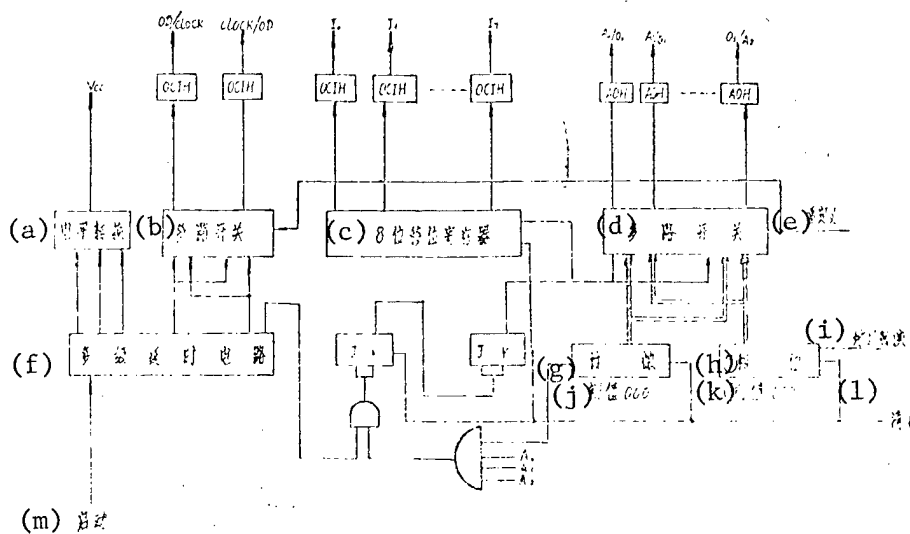


Figure 11

Key:

- |                             |                       |
|-----------------------------|-----------------------|
| a. Level conversion         | h. Shift              |
| b. Multiplex switch         | i. Address conversion |
| c. 8-place shift register   | j. Initial value 000  |
| d. multiplex switch         | k. Initial value 000  |
| e. Redefinition             | l. Clear 0            |
| f. Multilevel delay circuit | m. Start              |
| g. Counter [?]              |                       |

## 2) Logic Conversion Program

\*Main function: Depending on the user's design demands, a model is selected. The model along with logical expression form is input to the computer in character string form through an interactive terminal, then a fuse state information table or diagram which as programming control basis is produced.

\*Main algorithm: Since the distribution of the PAL device's internal fuses is unified in a 32x64 matrix form, one naturally thinks of mapping the 32x64 fuse matrix as a logical two dimensional mathematical array LFUSES (32x64) with each element in the logic array corresponding one to one with the corresponding fuse position. If an element is "true" it means the fuse is blown, if it is "false," it means that the fuse is preserved. The reverse is also possible.

Thus, the problem can be resolved into how to obtain this logical mathematical array. For this, the following factors must be considered:

(A) The device type: As we said above, the number and distribution of fuses in different models is different. For example, the numbering and quantity of product lines corresponding to output of one and the same pin in different types of devices is not always identical. Thus it is necessary to find the coefficient relationship for each type to be able to determine the product line pointer conveniently, depending on the type.

(B) Pin definition: To use the flexibility of PAL design fully, the name of each pin is defined entirely by the user. One can both define the original variable as well as define the contravariation, for example, pin 1 can be defined as L<sub>GP</sub> as well as L<sub>GP</sub> [sic]. Thus, when the variable names in an input logical expression are compared with the pin definition, the two are the same (match) indicating that they are positive or negative in common. The reason why this factor should be considered is that from the PAL logic diagram we know that the junctions of each input pin on the input line are neighboring, i.e., the primary signal is an even number and the contrasignal is an odd number. When the symbols in a logical expression are identical to the pin definition symbols, selecting an even numbered input line, or conversely, selecting an odd numbered one.

(C) From the PAL logic diagram we know that the corresponding relationship of pins of different type devices and input lines is relatively fixed. For example, the first pin corresponds to the second and third input line, the second pin corresponds to the zero and first input line. Thus, when defining pin names, as long as one goes strictly by the sequential order, once the names in the logical expression match the defined names, the pins will be determined correspondingly and the input lines will be determined correspondingly, and considered again in connection with the factor (B), one will at once be able to find the input line number, find the product line number and select the fuse position at once, and thus correspondingly determine the element position in the mathematical array.

Therefore the logic conversion program compares the symbols in the logical expression with the predefined pins and once there is a match, the corresponding fuse position is mapped to a corresponding element of a two-dimensional mathematical array. The flow chart is illustrated in Figure 12.

In the flowchart, the entire mathematical array ISYM (8,20) corresponds to 20 pin names and the logical mathematical array LFUSES (32,64) corresponds to the fuse matrix. The variable I<sub>BUF</sub> marks the positive and negative of the input variables.

When the logic conversion program has been completed, we finally obtain a two-dimensional mathematical array in logical form to make it easy for the user to search and print out the two-dimensional array information as 0/1 or H/L symbols in a 32x64 matrix form. This is the fuse state information table or information map required.

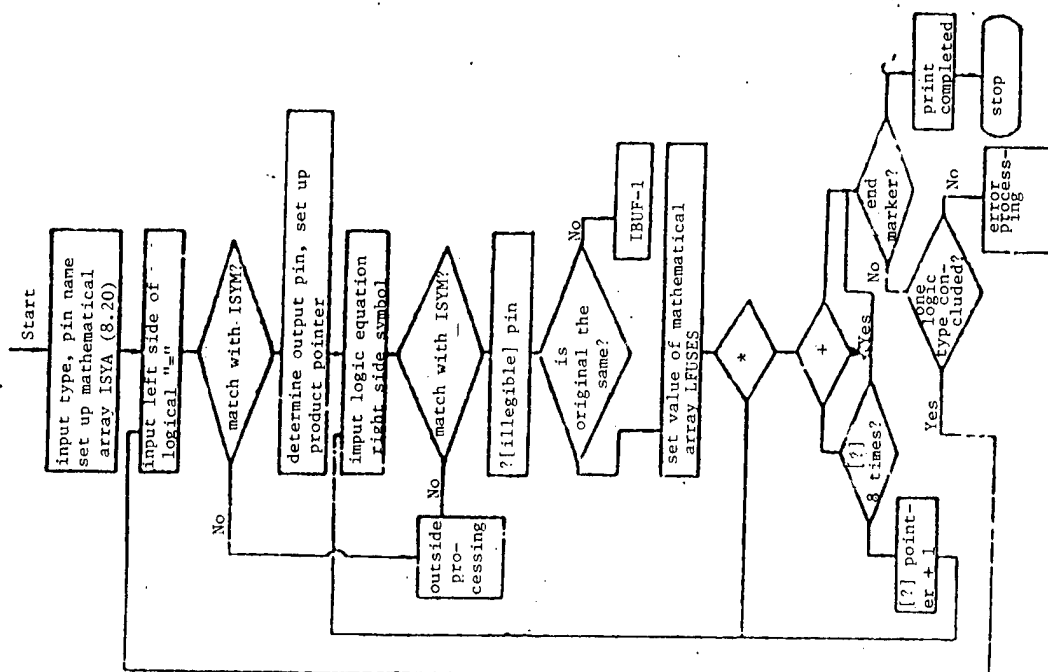
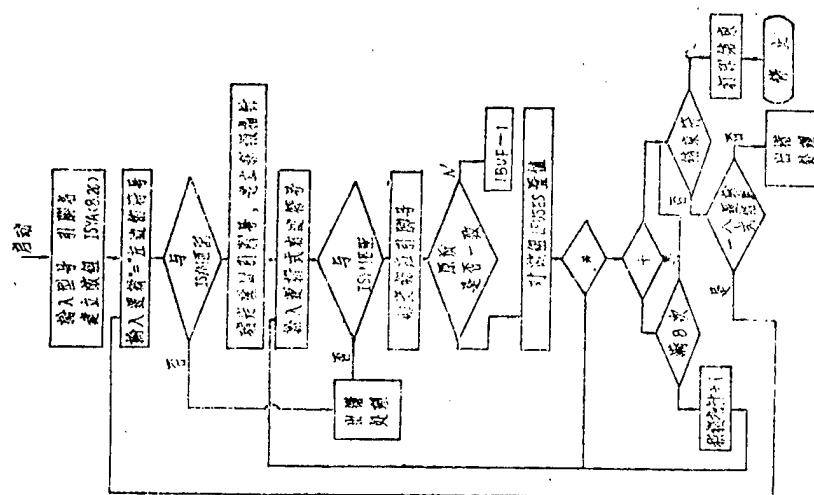


Figure 12



We can use this fuse state information to control the program which is fairly simple and we will not discuss it here.

#### IV. Conclusion

Above we have described computer-aided programming method for PAL devices and we have designed the related hardware and software. In view of the fact that China now uses imported foreign advanced systems as references and after analyzing them transplants them or develops her own products, if we use devices in existing systems to copy the devices we ourselves need, this is also a significant task, and as was pointed out earlier, because of the special PAL privacy, such copies are very difficult. The authors have carried out some explorations in this area and designed the relevant hardware and software and analyzed programmed PAL devices and obtained their logical expressions and using this logical expression to input the programmer described in this article indirectly obtained a copy. However, this task is now still limited to some types of devices and we are still searching for devices which certain powerful functions. Combining the analysis and programming systems will create a powerful hardware development system.

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8226/8309

CSO: 4008/1016

APPLIED SCIENCES

IMPROVED Y-7, Y-12 AIRCRAFT DESCRIBED

Beijing HANGKONG ZHISHI [AEROSPACE KNOWLEDGE MAGAZINE] in Chinese No 12,  
Dec 85 p 3

[Article by Bu Shilin [0592 4258 2651]]

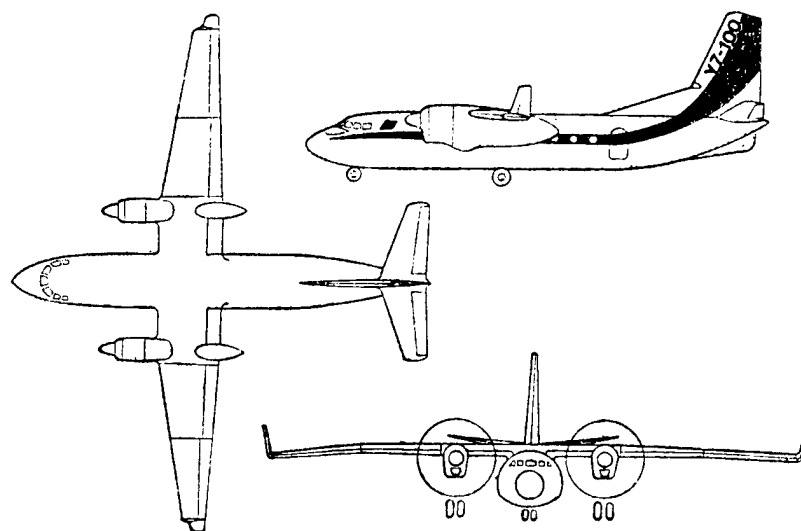
[Text] In late September, the climate in Beijing was delightful, and the city was getting ready for the 36th anniversary of the People's Republic; at the same time, it was celebrating the successful adjournment of the National Party Congress. On the parking area of the Nanwan Airport stood two Chinese-made civilian airplanes painted bright white with red and blue stripes.

One was the Chinese-made Y-7 aircraft. After the first successful test flight in 1982, significant improvements have been made over the past 3 years to enhance its performance. During the period from January to August of this year, a joint effort was initiated between the Chinese Technology Import/Export Co. and the Hong Kong Aircraft Engineering Co. (MAECD) to convert the more than 30 electronic and other airborne equipment on the Y-7 aircraft. This equipment includes: the environment control system, the atmospheric data system, the ultra-shortwave radio station, the magnetic navigation reference system, the attitude reference system, the Omega navigation system, the weather radar, the guidance system, the ranging device, and the bearing receiver. In addition, improvements were made in the passenger cabin: fire-proof sealing materials were used, light-weight, comfortable seats were installed, and sound-proofing measures were taken to reduce the noise level by 8 dB. New air-conditioning units, reading lights, and oxygen supply equipment were also installed. As a result of using advanced electronic equipment, the number of flight crew was reduced from 5 to 3, thus making room for two more passengers. The total number of passengers is 52. The Y-7 aircraft is equipped with two W15A-1 turboprop engines, each with a maximum rated take-off shaft power of 2,650 hp and a design life of 9,000 hours. The converted Y-7 is called the Y-7-100. In terms of electronic equipment, the aircraft has comparable technology as the Boeing 737; in terms of cabin facilities, it is more advanced than the Soviet An-24 aircraft.

The other aircraft was the Y-12, which is an improved version of the Y-11, a multi-function light aircraft. It has two engines, a high wing design, a single vertical tail assembly, and fixed tricycle landing gear. The engine is a Pratt and Whitney PT6A turboprop imported from Canada; its usable power

is 620 shaft hp. The Y-12 can carry 17 passengers, has a maximum cruising speed of 328 km/hr, and can take off and land on unimproved runways. Agreement was made with MAECD to convert its interior by installing comfortable chairs, air-conditioning system, lighting and call systems, and reducing the noise and vibration levels; its exterior was coated with high-quality paint.

During the 2-day exhibit on 26 and 27 September, the aircraft were visited by delegates at the Party Congress, and representatives of the China Aviation Establishment, Air Force and Naval units of the People's Liberation Army, the Commission of Science, Technology and Industry for National Defense, and the Ministries of Geology, Agriculture and Forestry, Posts and Telecommunications, and Finance. Everyone was pleased with the improvements made to the airplanes and hoped that they would soon be available for service.



#### Technical Data of the Y-7

##### Exterior dimensions:

Wing span	29.639 m
Length	23.700 m
Height	8.553 m
Wing area	74.98 m <sup>2</sup>

##### Interior dimensions:

Length of cabin	10.50 m
Width of cabin	2.80 m
Height of cabin	1.90 m
Cabin volume	56.0 m <sup>3</sup>
Forward luggage compartment	4.5 m <sup>3</sup>
Rear luggage compartment	6.7 m <sup>3</sup>

##### Weight and payload:

Maximum take-off weight	21,800 kg
Maximum landing weight	21,800 kg



Empty weight	14,900 kg
Maximum fuel capacity	4,790 kg
Maximum effective payload	5,500 kg
Maximum commercial payload	4,700 kg
Performance data:	
Maximum level flight speed	518 km/hr
Maximum cruising speed	484 km/hr
Efficient cruising speed	423 km/hr
Sea-level climb rate	7.64 m/sec
Operating ceiling (dual engine)	8,750 m
Operating ceiling (single engine)	3,900 m
Take-off distance	
(sea-level, international standard atmosphere)	1,248 m
(sea-level, international standard atmosphere $\pm 20^{\circ}\text{C}$ )	1,398 m
Landing distance	620 m
Range (carrying 52 passengers)	910 km
Range (full fuel capacity)	
(without auxiliary tank)	1,900 km
(with auxiliary tank)	2,420 km

3012/6091

CSO: 4008/33

## APPLIED SCIENCES

### DETAILS OF Y-12I STOL AIRCRAFT PRESENTED

Beijing HANGKONG ZHISHI [AEROSPACE KNOWLEDGE MAGAZINE] in Chinese No 12,  
Dec 85 pp 4-5

[Article by Song Zhaolin [1345 2600 2651]]

[Text] On 29 February 1984, a big crowd gathered at the Hebei Chengde Airport to witness a demonstration flight test of the Y-12I aircraft.

The Y-12I is a newly developed, twin-engine turboprop, short take-off and landing multi-function airplane. It can be used for transportation, parachuting as well as for various applications in geology, agriculture and forestry; it can also be converted into a special-purpose airplane for precision search operation. Development of the airplane began in 1980 based on design guidelines specified in section 23 of the U.S. Federal Aviation Regulations. After the completion of feasibility studies, design, manufacturing, and flight tests, the Y-12I successfully passed the technical certification on 17 December 1983 by a certification committee organized jointly by the Ministry of Aviation Industry and the Ministry of Geology and Mineral Resources, and was officially approved for service.

#### Design Features

The fuselage of the Y-12I has a semi-rigid metallic structure, and is divided into three sections: the forward cabin, the passenger/cargo cabin, and the forward and rear luggage compartments. Below the passenger/cargo cabin are two subwings which are used as anchors for the main landing gear and the tilted support rods. The skeleton, the main girder, and the skin of the basic structure are all made of aluminum alloys. The windshield and windows of the passenger/cargo cabin are made of organic glass, and the deck of the passenger/cargo cabin and the rear luggage compartment are of honeycomb structure. The passenger/cargo cabin is 4.82 m long, 1.46 m wide and 1.7 m high, and its floor loading is 750 kg/m<sup>2</sup>. The floor loading of the luggage compartment is 488 kg/m<sup>2</sup>.

The wing has a double-spar box type metallic structure with a rectangular planform. It uses an advanced high lift-to-drag ratio GA-0417 airfoil, and has dihedral of 1°41', an aspect ratio of 8.62, and a wing area of 34.27 m<sup>2</sup>. The skin of the wing is bonded to the main girder; the other joints are riveted.

The tail assembly consists of a trapezoidal vertical tail and a rectangular horizontal tail; both of which are of metallic structures. The skin of the forward section of the elevator and the rudder is 0.6 mm thick; over the rear section, it is 0.3 mm thick. On the geological model of the Y-12I, the elevator and rudder are equipped with counter-weights made of cast-bronze material. The trim tabs of the elevator and the rudder are operated by motor-driven mechanisms.

The power plant of the Y-12I consists of two Pratt and Whitney turboprop engines installed on the inboard sections of the wing; each engine can produce 500 shaft horsepower.

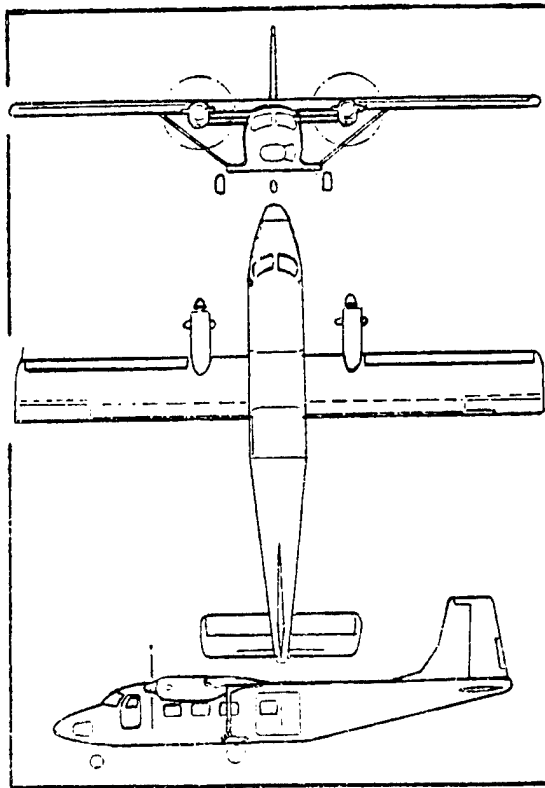
The nose gear is attached to the third frame of the fuselage; the main landing gear is attached to the forward beam axle of the subwing. The nose gear is of column design, and the main landing gear is of swing-arm design; both are equipped with hydraulic dampers. When the damping column of the front landing gear is compressed by 40 mm, the upper and lower cams of the positioning mechanism become completely disengaged, and the wheel is free to rotate about the damping column. The shimmy damper has a piston type design; it prevents shimmy vibration by passing high-speed, pressurized hydraulic fluid through the damping holes.

The aileron control unit in the main control system uses a mixed type mechanical drive. The elevator control unit uses double steel cables; both the elevator and rudder control units use soft/hard type mechanical drives. In the auxiliary control system, the fully retractable Fowler flaps are controlled using a mixed electrical-mechanical drive. The manual control unit of the airplane uses a disc type dual control device with Y-column structure. The foot control unit uses a four-bar linkage with adjustable foot pedals. The pilot and co-pilot each has his own control; they can operate the controls either simultaneously or individually.

#### Technical Performance

Based on large amount of ground test and flight test results, the design of the Y-12I aircraft has proven to be successful. The aircraft has superior flight performance and good operating results; it is safe, reliable, and efficient.

The technical data of the Y-12I are as follows: wing span--17.235 m, length--14.86 m, height--5.575 m; design take-off weight--5,000 kg, empty weight--3,000 kg, maximum payload--1,700 kg, maximum fuel capacity--1,230 kg; maximum cruising speed ( $H = 3,000$  m)--328 km/hr, operational speed--180 km/hr, climb rate ( $H = 0$  m)--6.5 m/sec, single-engine climb rate ( $H = 0$  m)--0.6 m/sec; cruising altitude--3,000 m, single-engine ceiling--1,750 m, dual-engine ceiling--greater than 7,000 m, take-off distance--234 m, landing distance--219 m, range--1,440 km, endurance--6.9 hours.



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APPLIED SCIENCES

BRIEFS

SILICON CARBIDE FIBER RESEARCH--Changsha, 28 October (XINHUA)--Some results of laboratory research in silicon carbide fiber and its basic material, polycarbo-silicane [ju tan qui wan 5112 8955 8944 7909], passed state appraisal in Changsha on 27 November. The achievement has opened up a new field for China in silicon-carbon polymer chemistry. The achievement was made by the No 505 Research Office of the Fifth Department of the University of Science and Technology for National Defense after five years of painstaking research, with the support of other concerned organizations. [Excerpt] [Beijing XINHUA Domestic Service in Chinese 0744 GMT 28 Oct 85 OW] /12913

CHINESE CHARACTER COMPUTER PROGRAM--Beijing, 17 December (XINHUA)--A computer program for processing Chinese character information was developed by Zheng Yili, a linguist who has devoted his whole life to the study of Chinese characters. The program, named "26-Key Coding Program for Chinese Characters," divides the 6,763 commonly used Chinese characters into 26 main groups and 69 subgroups by their roots, and codes them accordingly. Using the program, a semiskilled operator is capable of typing 60 characters per minute. [Summary] [Beijing XINHUA Domestic Service in Chinese 1157 GMT 17 Dec 85 OW] /12913

LASER SURVEY INSTRUMENT--Beijing, 3 November (XINHUA)--China has successfully tested a new type of laser survey instrument. Capable of accurately surveying objects within a range of 1 to 75 meters, the instrument is suitable for use in aircraft manufacturing, shipbuilding, energy, and large high-precision machinery processing. [Summary] [Beijing XINHUA Domestic Service in Chinese 1513 GMT 3 Nov 85 OW] /12913

NEW OPTICAL MATERIAL--Beijing, 22 December (XINHUA)--A new optical material, capable of changing an invisible infra-red laser beam into visible green has been developed by the Artificial Crystal Research Institute under the State Administration of Building Materials Industry. The material, named "potassium oxygenic titanium phosphate," [lin suan yang tai jia 4340 6808 8638 7835 6905] is an artificially-made single crystal, and is ideal for developing laser telecommunications from submarines, exploring continental shelves, and distance-measuring by man-made satellites. It was learned that only two countries, China and the United States, had developed such crystals which can be practically used in laser devices. [Summary] [Beijing XINHUA Domestic Service in Chinese 0306 GMT 22 Dec 85 OW] /12913

CSO: 4008/1034

## SCIENTISTS AND SCIENTIFIC ORGANIZATIONS

### MEDICAL JURISPRUDENCE SOCIETY ESTABLISHED

OW311845 Beijing XINHUA in English 1456 GMT 31 Oct 85

[Text] Zhengzhou, 31 Oct (XINHUA)--The Chinese Medical Jurisprudence Society was set up at a five-day meeting which ended today in Luoyang City, Henan Province.

The Society is aimed at developing the country's medical jurisprudence and boosting cooperation with foreign academic institutions in the field, according to Li Boling, chairman of the Society.

It will also open seminars and help tackle problems in the practice of medical jurisprudence, he added.

The regulations of the Society were passed at the meeting, which was attended by 300 specialists. Over 300 academic papers were also presented at the meeting.

China's medical jurisprudence has a long history. "The washing away of wrong" by the practitioner Song Ci in 1247 is believed to be the first work on medical jurisprudence in the world. The book was later introduced to many foreign countries.

China at present has over 7,000 practitioners in the field. There are also more than 500 students majoring in this subject in colleges and universities.

The country has spent 21 million yuan since last year on opening medical jurisprudence departments and courses in six of its key institutions of higher learning, Li noted.

/12712  
CSO: 4010/1027

Acoustics

VIBRATION AND NEAR SCATTERING FIELD OF IMMERSED RECTANGULAR ELASTIC-VISCOELASTIC COMPOSITE PLATE IN AN UNDERWATER SOUND FIELD (I)--ANALYSIS OF RECTANGULAR COMPOSITE PLATE SYSTEM

Beijing SHENGXUE XUEBAO [ACTA ACUSTICA] in Chinese Vol 10 No 6, Nov 85  
pp 344-357

[English abstract of article by He Zuoyong [0149 4373 6978] of Harbin Shipbuilding Engineering Institute]

[Text] Based on the theory of elasticity, according to the least elastic energy and variational method, the neutral plane position of the elastic composite plate system is determined. Then, the governing equations for the flexural vibration of composite elastic-viscoelastic laminar plates are derived.

It is shown that the governing equations and boundary conditions of this composite plate system are similar to those of thin plates if the equivalent rigidity, Poisson's ratio and surface-mass density are used instead of the parameters in equations and boundary conditions.

The general solution for bending motion of this plate system is given by the normal mode analysis method and Fourier analysis. As an example, a simply-supported, rectangular composite plate system is presented. The equivalent rigidity, Poisson's ratio and surface mass density for bilaminar plate systems with steel as the base plate coated with rubber, plastic or a ceramic layer are numerically calculated. The damping constant, resistant coefficient and natural frequency for different vibration modes of this system with edges simply-supported are also calculated.

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ANGULAR DISTRIBUTION OF THE SOUND FIELD IN SHALLOW WATER

Beijing SHENGXUE XUEBAO [ACTA ACUSTICA] in Chinese Vol 10 No 6, Nov 85  
pp 358-364

[English abstract of article by Zhu Baixian [2612 2672 6343] of the Institute of Acoustics, Chinese Academy of Sciences]

[Text] The field of a harmonic point source in layered media has a certain angular distribution. Although by ray theory the angular distribution of the sound field can be calculated for a given receiving point, the effect of the frequency on the angular distribution function and the sound field in the shadow zone cannot be calculated. In this paper the angular distribution of the sound field in a layered media is discussed using the normal-mode theory, and the general expression of angular distribution function and attenuation law for directional reception are obtained. The results given can be used for calculating the sound field in the shadow zone and they represent the influence of the frequency on the sound field. The channel of the underwater sound and the effect of the signal detection in it are investigated, the results of which can be used in choosing the optimum receiving direction. The numerical calculations are produced for the given medium model, and an analysis and discussion are given.

EXPERIMENTAL STUDY OF VISCERAL INJURIES OF RABBITS RESULTING FROM NOISE  
EXPOSURE

Beijing SHENGXUE XUEBAO [ACTA ACUSTICA] in Chinese Vol 10 No 6, Nov 85  
pp 365-371

[English abstract of article by Qian Weiquan [6929 4850 2936], Zheng Suxian [6774 4790 6343] and Huang Duansheng [7806 4551 3932], et al., of the Institute of Space Medico-Engineering, Beijing; and Wei Wen [7614 2429], et al., of the Institute of Acoustics, Chinese Academy of Sciences]

[Text] This paper describes the characteristics of visceral injuries of rabbits exposed to a wide-band noise field of 168 dB sound pressure level. The experimental results demonstrate that the injury sites are dependent on the posture of the animals. For animals in free or prone posture the most vulnerable organ is the lung, which opens to the outer atmosphere, and next are the hollow organs, such as the stomach and the intestines. For animals exposed in supine posture the heart is usually as seriously injured as the lungs, and parts of the stomach, intestines and liver which are situated near the abdominal wall also show some significant injuries. Our experimental results reveal that the primary pathological cause of organ injuries is the mechanical effect of the sound waves.

9717

CSO: 4009/31

Electronics

A NEW KIND OF PULSE-TO-PULSE AGILE CODES AND THEIR STATISTICAL PULSE  
COMPRESSION CHARACTERISTICS

Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese Vol 13 No 4,  
Jul 85 pp 1-8

[English abstract of article by Su Zefeng [5685 3419 1496] of Southwest  
China Research Institute of Electronic Technology, Chengdu]

[Text] The radar signal design and signal processing are investigated comprehensively to obtain the optimum statistical pulse compression characteristics (SPCC). First, the SPCC of a code set with  $L$  codes is studied that is obtained by truncating a cyclic PN code in a fixed step length with the truncated length  $L$  being equal to the code length of the cyclic PN code and transmitted in turn to implement the code agile in pulse-to-pulse (CAPP). The general expressions of SPCC for the kind of codes mentioned above are derived. The peak ratio of the main-lobe to side-lobe (RMS) of SPCC within the pulse repetition period (PRP), referred to as RMS in the near region, is greater than  $L$ , but is very small outside the PRP, which is referred to as RMS in the far region. Next, in order to improve the RMS of SPCC in the far region for the code set mentioned above, a code set truncated from a cyclic PN code in a stochastic step length is proposed with the truncated length  $L$ . Although these agile codes have a good RMS of SPCC in the far region when compared with that of the previous one, these agile fashions are considerably fewer than those with a fixed step length. Finally, a new kind of pulse-to-pulse agile code (NKPPAC) and their SPCC are investigated by means of computer simulation. The RMS in the near region for the NKPPAC is the same as the one the truncated PN code set gave, and that in the far region is also greater than  $L$ , except for a very few code sets with a particular code length  $L$  in a particular agile step length. Even so, in the last case the difference from  $L$  of RMS of SPCC in the far region is also very small. If the code length  $L$  is sufficiently large, the high RMS of SPCC required can be achieved without weighted processing. This will lead to simplification of the hardware for engineering implementation. The hardware experiment proves that the NKPPAC generators are very simple, an asset for engineering applications. (Paper received in December 1984; finalized in March 1985.)

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## THEORY OF OPEN RESONATORS FORMED BY IRREGULAR WAVEGUIDES

Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese Vol 13 No 4,  
Jul 85 pp 23-29

[English abstract of article by Xu Kongyi [1776 1313 5030] and Liu Shenggang  
[0491 4141 4854], Chengdu Institute of Radio Engineering]

[Text] A new theoretical method for analyzing open waveguide resonators is given. In order to overcome the difficulty caused by different boundary conditions on each end of the cavity, an unknown separation surface of fields is set up in this method. In this way analytical solutions for the fields, including diffraction output power, are obtained. All the theoretical results agreed satisfactorily with the experiments.

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## A TAYLOR PATTERN FAMILY FOR APERTURE ANTENNAS

Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese Vol 13 No 4,  
Jul 85 pp 30-36

[English abstract of article by Fang Tongcheng [2455 0681 1004] and Li Junpei [2621 3182 3099] of Nanjing Research Institute of Electronic Technology]

[Text] In order to study the inherent relationships for the most often used patterns and find new patterns a new synthesis technique, the Taylor Pattern Family (TPF) for aperture antennas, is developed. The TPF is introduced and its zeros are corrected by the conventional Taylor Pattern. For the TPF, its constructions, fundamental pattern family and visual coordinates ( $S$ ,  $\alpha_1$ ,  $\alpha_2$ ) are discussed. The new parameter  $\alpha_1$  and the corrected  $\sigma$  are of importance to the analysis and synthesis of monopulse antennas for low sidelobes. Two examples of the TPF are described. (Paper received December 1983; finalized October 1984.)

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## A NEW CIRCUIT MODEL OF THE HARMONIC OSCILLATOR

Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese Vol 13 No 4,  
Jul 85 pp 36-41

[English abstract of article by Wu Zhengde [0702 2973 1795] of Chengdu  
Institute of Radio Engineering]

[Text] Based on the dynamic Van der Pol nonlinearity model, the second and third harmonic oscillators are studied using the describing function method. The electrical characteristics and tune sensitivity of the fundamental frequency and harmonic loops under the optimum conditions are discussed. The basic principles for designing the harmonic oscillator are proposed. In addition, a new circuit model with good tunability and highest output power is given. (Paper received January 1984; finalized August 1984.)

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# CALCULATION OF THE SHIFTED FOCAL AXIS ANTENNA BY SPHERICAL WAVE THEORY

Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese Vol 13 No 4,  
Jul 85 pp 56-64

[English abstract of article by Li Zhenxing [2621 2182 5281] and Mao Yukuan  
[5403 0060 1401] of Northwest Telecommunication Engineering Institute, Xian]

[Text] The scattered field from the subreflector, the secondary radiation patterns and the efficiency of the shifted focal axis antenna are analyzed by means of spherical wave expansions, diffraction theories, etc. The calculated results are in good agreement with the experimental ones, and show that these formulas are effective for engineering design. (Paper received January 1984; finalized October 1984.)

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# EXACT DESIGN OF SWITCHED-CAPACITOR FILTERS USING SIGNAL-FLOW GRAPHS AND TWO-INTEGRATOR-LOOP

Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese Vol 13 No 4,  
Jul 85 pp 64-67

[English abstract of article by Zha Qiangzhong [2686 1730 0022] of the  
Department of Electrical Engineering, Chongqing University]

[Text] A new technique for directly designing bilinear switched-capacitor filters using signal-flow graphs and the two-integrator-loop is described. This simple and flexible method is applicable to all types of SCFs. The resulting circuits have low sensitivities both to element value variations and to parasitic capacitances. (Paper received January 1984; finalized August 1984.

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# STUDY OF I-V CHARACTERISTICS IN InGaAsP/InP DH LED'S

Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese Vol 13 No 4,  
Jul 85 pp 108-111

[English abstract of article by Zhang Guicheng [1728 2710 2052], Chen Ruizhang [7115 3843 3864] and Yang Linbao [2799 2651 1405] of Shanghai Institute of Metallurgy, Chinese Academy of Sciences]

[Text] I-V characteristics of InGaAsP/InP DH LED's are investigated, especially the dependence of  $V_f$ ,  $V_0$  and  $V_B$  on the active layer's acceptor concentration, the location of the p-n junction, the dopant for the p-InP confining layer, the heat sink temperature and the fabrication techniques, as well as the dependence of I-V characteristics on the light output power and the spectral characteristics. Reasons are explained for the devices having different I-V characteristics. (Paper received February 1984; finalized September 1984.)

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9717

CSO: 4009/1023

Physics

THE FAMILY PROBLEM OF QUARKS AND LEPTONS IN TWO KINDS OF COMPOSITE MODELS

Beijing GAONENG WULI YU HE WULI [PHYSICA ENERGIAE FORTIS ET PHYSICA NUCLEARIS]  
in Chinese Vol 9 No 6, Nov 85 pp 660-668

[English abstract of article by Yang Xin'e [2799 2450 1230] of the Department  
of Physics, Tianjin University]

[Text] Two kinds of  $SU(3)_{sc} \times SU(N)$  composite models (model A and model B) of quarks and leptons are suggested to solve the family problem. The constituents (preons) of the models are two types of massless spin-1/2 fermions which belong to  $(3, N)$  and  $(3, N^*)$  representations of the gauged symmetry group  $SU(3)_{sc} \times SU(N)$ . Applying the Fermi principle to three-preon supercolor-singlet composite fermions and according to the models' requirements (the fermions in one family originate from the same representation of  $SU(N)$  and belong to the same representation of the horizontal gauge group), one obtains the family-number of  $SU(3)_{sc} \times SU(N)$ , where  $SU(3)_{sc} \times SU(6)$  and  $SU(3)_{sc} \times SU(5)$  of model A predict three and five generations respectively.

ELECTRO-WEAK UNIFIED THEORY--A MODEL IN  $SU(3) \times U(1)$

Beijing GAONENG WULI YU HE WULI [PHYSICA ENERGIAE FORTIS ET PHYSICA NUCLEARIS]  
in Chinese Vol 9 No 6, Nov 85 pp 679-686

[English abstract of article by Chen Shihao [7115 0013 3185], Northeast Teachers' University]

[Text] An electro-weak unified model based on the  $SU(3) \times U(1)$  group is suggested which is left-right symmetrical and assumes the same interactions of neutrinos (or antineutrinos) with charge leptons and antileptons before spontaneous symmetry breaking. It is anomaly free and  $\sin^2\theta_w \lesssim 1/4$  can be derived. The difference between the model and the Weinberg-Salam model is very small in the low energy range. The lepton number is generalized to the lepton charge. It is proved that only the lepton charge is strictly conserved and the individual conservation of the lepton number of every generation of leptons is held only approximately. The quarks not only have baryon numbers and charges but also lepton charges. This model predicts processes  $\mu\bar{R} \rightarrow e\bar{R} + \nu_{eL} + \nu_{\mu R}^c$ ,  $e\bar{L} + e\bar{R} \rightarrow \mu\bar{L} + \mu\bar{R}$ , etc.

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A METHOD FOR CALCULATING PHOTON STRUCTURE FUNCTION IN DEEP INELASTIC SCATTERING

Beijing GAONENG WULI YU HE WULI [PHYSICA ENERGIAE FORTIS ET PHYSICA NUCLEARIS]  
in Chinese Vol 9 No 6, Nov 85 pp 697-702

[English abstract of article by Lu Jingxian [7120 2529 6343] of the Institute of High Energy Physics, Chinese Academy of Sciences]

[Text] This paper discusses the behavior of the photon structure function, considered to be a superposition of a hadronic and a pointlike component. The pointlike component is calculated in the quark parton model. The hadronic part is calculated in the vector dominance model. The valence quark distribution function of  $\rho^0$  is assumed to be the same as that of  $\pi^0$ . The  $\pi^0$  valence quark distribution function is represented by an analytic expression in the leading logarithm approximation from the Altarelli-Parisi equation. Results obtained are in agreement with experimental data.

THE STOCHASTIC EQUATIONS IN THE LATTICE GAUGE FIELD THEORY AND THE SCHWINGER-DYSON EQUATION FOR THE WILSON LOOP VARIABLE

Beijing GAONENG WULI YU HE WULI [PHYSICA ENERGIAE FORTIS ET PHYSICA NUCLEARIS] in Chinese Vol 9 No 6, Nov 85 pp 703-711

[English abstract of article by Xue Shesheng [5641 4357 3932] and Xian Dingchang [0405 7844 2490] of the Institute of High Energy Physics, Chinese Academy of Sciences]

[Text] The method of stochastic quantization is applied to the lattice gauge field theory and the Langevin equations for the link and Wilson loop variables are established for the  $U(N)$  and  $SU(N)$  cases. The relationship between the Langevin equation and the Schwinger-Dyson equation for the Wilson loop is discussed.

# ROTATIONAL MODEL AND HIGH ENERGY SCATTERING

Beijing GAONENG WULI YU HE WULI [PHYSICA ENERGIAE FORTIS ET PHYSICA NUCLEARIS]  
in Chinese Vol 9 No 6, Nov 85 pp 712-717

[English abstract of article by Zhang Yushun [1728 4416 7311] of the  
Institute of High Energy Physics, Chinese Academy of Sciences]

[Text] In this paper the differential cross sections of the inelastic scatterings of protons of energy  $\sim 1$  GeV on  $^{152}\text{Sm}$ ,  $^{154}\text{Sm}$  and  $^{176}\text{Yb}$  are calculated using the collective coordinate and high energy cluster scattering theory, and using an axially symmetric rotational model and an optical model with a Woods-Saxon potential. The results are in agreement with experimental data.

RESEARCH ON ELASTIC SCATTERING INDUCED BY 7-5 MeV/A  $^{14}\text{N}$  ON  $^{59}\text{Co}$  AND  $^{51}\text{V}$

Beijing GAONENG WULI YU HE WULI [PHYSICA ENERGIAE FORTIS ET PHYSICA NUCLEARIS]  
in Chinese Vol 9 No 6, Nov 85 pp 718-722

[English abstract of article by Shen Wenqing [3088 2429 1987], Zhu Yongtai [6175 3057 3144] and Zhang Yuhu [1728 3768 5706], et al., of the Institute of Modern Physics, Chinese Academy of Sciences; and Zheng Zhihao [6774 1807 6275] of Lanzhou University]

[Text] The energy spectra and angular distributions induced by 7-5 MeV/A  $^{14}\text{N}$  on  $^{59}\text{Co}$  and  $^{51}\text{V}$  are measured using a semiconductor detector. The atomic numbers and quantities of the contaminated heavy element are determined. The angular distributions of the elastic scattering are fit using the General Fresnel model. The possibility of extracting the quasi-elastic cross section from the fitting procedure is discussed.

LOW ENERGY CROSS SECTION MEASUREMENT OF D-D AND D-T REACTIONS\*

Beijing GAONENG WULI YU HE WULI [PHYSICA ENERGIAE FORTIS ET PHYSICA NUCLEARIS]  
in Chinese Vol 9 No 6, Nov 85 pp 723-735

[English abstract of article by the First Research Group, First Research  
Division, Institute of Modern Physics, Chinese Academy of Sciences]

[Text] The cross sections of a deuteron-deuteron reaction for deuteron energy from 15 keV to 150 keV and of a deuteron-tritium reaction for deuteron energy from 13.8 keV to 114.3 keV were measured using the process of passing a deuteron and tritium beam into a gas target formed by a differential pumping system and two capillary pipes. Experiments in two step-angular distribution measurement and absolute differential cross section measurement were performed at three Cockcroft-Walton generators with terminal voltages of 50 kV, 150 kV and 300 kV. Empirical fit of the D-D reaction data to the Gamow formulae and a comparison of the D-T reaction data with BWE theory are given.

\* This research was completed in 1970.



PHASE-SHIFT ANALYSIS AND GENERALIZED EIGENVALUE ANALYSIS OF THE  $d-\alpha$  CLUSTER  
STRUCTURE OF  ${}^6\text{Li}$

Beijing GAONENG WULI YU HE WULI [PHYSICA ENERGIAE FORTIS ET PHYSICA NUCLEARIS]  
in Chinese Vol 9 No 6, Nov 85 pp 742-750

[English abstract of article by Zhao Xuan [6392 3763], Hou Renchang [0186 0088  
9480] and Zeng Fanan [2580 4907 1344] of Shanghai Institute of Nuclear  
Research, Chinese Academy of Sciences]

[Text] By using the  $d-\alpha$  cluster-structure wave function and the nucleon-  
nucleon (N-N) force containing a soft-repulsive core central potential and a  
spin-orbit noncentral potential, the  $(1^+,0)$  ground state,  $(3^+,0)$  first excited  
state,  $(2^+,0)$  third excited state and  $(1^+,0)$  fifth excited state of  ${}^6\text{Li}$  are  
studied by phase-shift analysis and generalized eigenvalue analysis with  
single-channel resonating group method (RGM). The results show that, from the  
phase-shift and eigenvalue analyses, the ground state of  $\text{Li}$  is mainly an  
 $l=0$   $d-\alpha$  cluster-structure bound state, and the first, third and fifth excited  
states of  $\text{Li}$  are mainly  $(1,J)=(2,3)$ ,  $(2,2)$  and  $(2,1)$  cluster-structure unbound  
states, respectively.

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CSO: 4009/30

Radiation Protection

A SURVEY OF RADIATION PROTECTION FOR PARTICLE ACCELERATORS IN CHINA

Taiyuan FUSHE FANGHU [RADIATION PROTECTION] in Chinese Vol 5 No 6, Nov 85  
pp 401-408

[English abstract of article by Song Shushou [1345 2579 4849] of the  
"Particle Accelerator Radiation Protection Regulations" Compilation Team]

[Text] This paper summarizes general aspects of radiation protection for 43 sets of particle accelerators in China, including radiation shielding, radiation safety systems, radiation monitoring, radiation accidents and radiation safety administration, etc. Some problems in radiation protection presented by particle accelerators are analyzed. It is recommended that they be paid attention to and solved soon.

TREATMENT OF LIQUID WASTES CONTAINING ACTINIDES AND FISSION PRODUCTS USING AN INORGANIC ION EXCHANGER--SODIUM TITANATE

Taiyuan FUSHE FANGHU [RADIATION PROTECTION] in Chinese Vol 5 No 6, Nov 85 pp 415-421, 408

[English abstract of article by Yu Ying [0205 3853], Lin Meiqiong [2651 5019 8825] and Fan Xianhua [5400 7359 5478], et al., of the Institute of Atomic Energy]

[Text] The laboratory-scale synthesis, analysis and exchange performance for actinides and fission products of an inorganic ion exchanger, sodium titanate, were investigated. The effect on the distribution ratio was also investigated for several cations and organic complex agents which might exist in nuclear fuel reprocessing high-level liquid wastes. It was found that the exchange capacity of sodium titanate was not changed after irradiation of up to  $5 \times 10^8$  rad. The experiment on low-level liquid wastes from the Institute of Atomic Energy ( $10^{-6}$  Ci/L calculated as gross  $\beta$  activity) using synthetic sodium titanate showed that the decontamination factor of Sr was greater than  $10^4$  for a 180 bed volume effluent and no less than  $10^3$  for a 1180 bed volume effluent. After further decontamination of Cs and Co in anionic complex state with natural zeolite and macroporous anion resin respectively, the specific activity of liquid wastes reached  $1 \times 10^{-10}$  Ci/L, near the discharge level of  $7 \times 10^{-11}$  Ci/L.

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